

Appendix 2:

Monitoring Plans and Recommendations

The applicant for course construction and/or their consultants may develop a surface and ground water monitoring plan for the golf course. This should be done in consultation with the NJDEP Pesticide Control Program (PCP), which will provide assistance regarding the most current monitoring and analysis recommendations.

In order to provide protection of receiving waters, it is necessary that monitoring programs be carefully designed and implemented. Three monitoring phases should be completed: baseline value monitoring, follow-up monitoring, and routine monitoring.

The baseline monitoring protocol for both surface and ground waters should be quarterly for one year prior to the start of construction.

The follow-up monitoring phase will begin with a pre-season sampling; a second sampling following the initial peak application period (typically late May-early June); a third sampling after the next peak application period (typically late July-early August); and the final following the last application period (mid-September). This protocol should include a period of three years for surface waters and two years for ground waters.

If no sign of contamination in the receiving waters is found during the follow-up phase, the routine monitoring phase will then be initiated. The routine monitoring should be performed on an annual basis following the season of peak pesticide and fertilizer application.

The surface water monitoring should be conducted under wet weather conditions which generate surface runoff. If other factors such as sensitive soil types, existence of endangered species, high quality receiving waterways, are of concern in the study area, more intensive sampling programs may be prudent. All sampling analysis should be done at a New Jersey State Certified Laboratory.

Ground Water Monitoring Program

Two concerns regarding potential ground water impacts caused by operation of golf courses are *quantity* impacts on downgradient wells and *quality* impacts from fertilizers and pesticides. A monitoring case study from Cape Cod, with modifications, is recommended for adoption as a basis for ground water

monitoring programs at New Jersey's golf courses. This study is available from the NJDEP Pesticide Control Program. In summary, the monitoring program includes the following:

a. Monitoring wells:

Monitoring wells should be located along the boundary of the golf course so as to monitor all possible sources of contaminants originating from within the golf course. Wells are also to be located both up and down gradient from the site. The number of wells should be determined in consultation with the PCP.

b. Lysimeter/Drain fields:

Pressure-vacuum lysimeters and drain fields are recommended for installation beneath greens and fairways to obtain water samples from the zone of aeration. These devices will enable the sampling of water leaching through the root zone before reaching the water table.

c. Sampling/ Analysis:

The applicant can contact the Division of Watershed Management to identify ground water standards for the parameters listed below. The applicant may sample each monitoring well quarterly for target chemicals during baseline and follow-up phases and annually during the routine monitoring phase or as specified by the department based on application rates of pesticides and fertilizers. Target chemicals for ground water sampling shall include:

1. All pesticides used on the golf course;
2. Any known pesticide metabolites;
3. Nitrate, Kjeldahl nitrogen, ammonia nitrogen, and other fertilizer related chemicals used on the golf course.

Additional monitoring rates and sites may be necessary when the golf course is to be located adjacent to wells used for potable water supply.

d. Ground water quantity monitoring:

Ground water level monitoring may be necessary to provide an additional degree of protection to adjacent well supplies. Water quantity wells should be identified and maximum drawdown levels established for each. The information will provide:

- natural water table fluctuations prior to golf course development and initiation of the irrigation process;
- ground water elevations for pre-determined monitoring wells.

If water level observations demonstrate a more pronounced impact on the water table than what had been prior estimated or modeled, NJDEP can place water usage restrictions on the pumping of irrigation wells. To determine if a

permit is necessary for the irrigation pumping system, the applicant is to contact the NJDEP Bureau of Water Allocation.

e. Reporting requirements:

After the follow-up monitoring period, the applicant may compile and submit to the Department the ground water quality data. For those pesticides which have not been detected in either aeration zone samples or ground water samples, the sampling frequency will be reduced to annual testing. If the concentration of pesticides or fertilizers and related pollutants are found to exceed allowable standards, the Department should be notified immediately and all pesticide and fertilizer application should be terminated pending further investigation.

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Surface Water Monitoring Program

Chemical Monitoring

Monitoring sites will be determined locally. The surface water parameters should be monitored on a quarterly basis during baseline and follow-up phases and on an annual basis during the routine phase. Months for sampling will be March, June, September, and December.

Storm water samples collected during the follow-up phase should coordinate with golf course operations. If a storm event occurs within a week after the application of fertilizer and/or pesticide, monitoring will be conducted.

The parameters for monitoring may include:

pH

Dissolved oxygen

Alkalinity

Total suspended solids

Total phosphorous

Total Kjeldahl nitrogen

Ammonia nitrogen

Nitrate nitrogen

Turbidity

Applicable pesticides

Inorganic fertilizer non-nutrient constituents

Site specific targeted constituents to be monitored should be determined by NJDEP and local authorities in cooperation with the golf course superintendent or the developer's environmental consultants. For information on surface water quality standards, the applicant can contact the Division of Watershed Management.

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